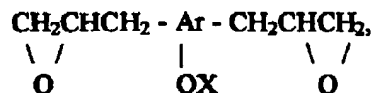


New Claim

20. (New) The diepoxide ethers of claim 1 having the formula



where Ar is a trivalent aromatic radical of 6-20 carbon atoms and X is -R, -COR, -COOR, -SO₂R, or -PORR' and R and R' are the same or different alkyl, alkylene aryl, aryl, arylene alkyl, alkylene alkoxy, alkylene aryloxy, arylene alkoxy and arylene aryloxy radical having from 6-20 carbon atoms.

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EXAMPLE 7

Preparation of Bis-1,2-[2-(2,3-Epoxypropyl)Phenoxy] Ethane

Bis-1,2-(2-allylphenoxy)ethane was prepared from 2-allylphenol and 1,2-dichloroethane as described in Example 6 with the following exception. The crude product was distilled in vacuo to remove unreacted 2-allylphenol and the monosubstituted product prior to filtration through silica gel to give a viscous oil. MS m/z 294 (M^+ calcd for $C_{20}H_{22}O_2=294$). 1H NMR (300 MHz, $CDCl_3$) δ 3.40–3.50 (d, 2, CH_2), 4.40 (s, 2, OCH_2), 5.05–5.14 (m, 2, CH_2 vinyl), 5.90–6.08 (m, 1, CH vinyl), 6.91–7.09 (m, 2, aromatic), 7.18–7.32 (m, 2, aromatic).

Oxidation as described in Example 6 gave the desired diepoxide as a viscous oil. MS m/z 326 (M^+ calcd for $C_{20}H_{22}O_4=326$). 1H NMR (300 MHz, $CDCl_3$) δ 2.57 (d, 1, CH_2 epoxypropyl), 2.64–3.00 (m, 3, CH_2 epoxypropyl), 3.14–3.30 (m, 2, CH epoxypropyl), 4.40 (s, 2, OCH_2), 6.89–7.02 (m, 2, aromatic), 7.70–7.55 (m, 2, aromatic).

EXAMPLE 8

Preparation of Bis-[2-(2,3-Epoxypropyl)Phenyl]Phenyl Phosphate

Phenyl dichlorophosphate (10.5 g, 0.05 mol) was added dropwise to a solution of 2-allylphenol (13.4 g, 0.1 mol) and triethylamine (13.9 ml, 0.1 mol) in 1,2-dichloroethane (200 ml) and the mixture refluxed for 2 hr. After cooling, the precipitate, triethylamine hydrochloride was filtered, and the organic solution washed with water, dried over anhydrous $MgSO_4$ and evaporated in vacuo. The unreacted 2-allylphenol was removed by vacuum distillation to give bis-[2-(2-allylphenyl)phenyl]phenyl phosphate as a viscous liquid. MS m/z 406 (M^+ calcd for $C_{24}H_{23}O_4P=406$). 1H NMR (300 MHz, $CDCl_3$) δ 3.46 (d, 4, CH_2), 4.95–5.15 (m, 4, CH_2 vinyl), 5.82–6.00 (m, 2, CH vinyl), 7.20–7.50 (m, 13, aromatic).

The above diepoxide was converted to the desired diepoxide as described in Example 6. 1H NMR (300 MHz, $CDCl_3$) δ 2.46 (d, 2, CH_2 epoxypropyl), 2.62–2.90 (m, 6, CH_2 epoxypropyl), 3.03–3.11 (m, 2, CH epoxypropyl), 7.21–7.51 (m, 13, aromatic).

EXAMPLE 9

Preparation of Isophthalic Acid: BIS-[2-(2,3-Epoxypropyl) Phenyl Ester]

Isophthaloyl dichloride (3.19 g, 0.0157 mol) and 2-allylphenol (4.21, 0.0313 mol) were diluted with dichloromethane (50 ml) and triethylamine (3.16 g, 0.0313 mol) added dropwise at room temperature. After stirring for 3 hr at room temperature, the amine hydrochloride was removed by filtration and the organic solution washed with water and dried over anhydrous $MgSO_4$. Evaporation of the solvent in vacuo gave the bis-allylphenyl isophthalate as a colorless oil. MS m/z 398 (M^+ calcd for $C_{26}H_{22}O_4=398$). 1H NMR (300 MHz, $CDCl_3$) δ 3.46 (d, 2, CH_2), 5.01–5.12 (m, 2, CH_2 vinyl), 5.90–6.05 (m, 1, CH vinyl), 7.20–7.40 (m, 4, aromatic), 7.65–7.77 (m, 1, aromatic), 8.25–8.33 (m, 1, aromatic), 9.05 (s, 1, aromatic).

The above diepoxide was converted to the desired diepoxide as described in Example 6. 1H NMR (300 MHz, $CDCl_3$) δ 2.5 (d, 1, CH_2 epoxypropyl), 2.62–2.96 (m, 3, CH_2 epoxypropyl), 3.22–3.30 (m, 1, CH epoxypropyl), 7.15–7.47 (m, 4, aromatic), 7.83–7.91 (m, 1, aromatic), 8.25–8.33 (m, 1, aromatic), 9.05 (s, 1, aromatic).

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EXAMPLE 10

Preparation of 3,6-Bis-[2-(2,3-Epoxypropyl)Phenoxy] Pyridazine

2-Allylphenol (10 g, 0.075 mol) was added to a solution of peracetic acid (30 g, 30% active) in dichloromethane (100 ml) that had been dried over anhydrous $MgSO_4$. The reaction mixture was stirred at room temperature for 48 hrs. The dichloromethane solution was washed with water, dilute aqueous $NaCO_3$, dilute aqueous $NaSO_3$, and dried over anhydrous $MgSO_4$. After evaporation of the solvent in vacuo, 2-(2,3-epoxypropyl)phenol was isolated as viscous liquid. MS m/z 150 (M^+ calcd for $C_9H_{10}O_2=150$). 1H NMR (300 MHz, $CDCl_3$) δ 2.65–2.80 (m, 2, CH_2 epoxypropyl), 2.87–2.93 (m, 1, CH_2 epoxypropyl), 3.10–3.21 (m, 1, CH epoxypropyl), 3.50–3.60 (m, 1, CH epoxypropyl), 6.80–7.25 (m, 4, aromatic). 2-(2,3-Epoxypropyl)phenol (0.9 g, 0.006 mol) was added to a solution of powdered sodium hydroxide (0.24 g, 0.006 mol) in dimethylacetamide (30 ml) and the solution heated at 80C for 1 hr. The reaction mixture was diluted with water and extracted with dichloromethane, dried over anhydrous $MgSO_4$ and evaporated in vacuo to give a solid that on recrystallization from methanol gave product mp 150–152C. MS m/z 376 (M^+ calcd for $C_{22}H_{20}N_2O_4=376$). 1H NMR (300 MHz, $CDCl_3$) δ 3.62 (dq, 2, CH_2 epoxypropyl), 4.57 (dq, 2, CH_2 epoxypropyl), 5.15–5.32 (m, 1, CH epoxypropyl), 6.78–6.93 (m, 2, aromatic), 7.11 (s, 1, heteroaromatic), 7.15–7.28 (m, 2, aromatic).

EXAMPLE 11

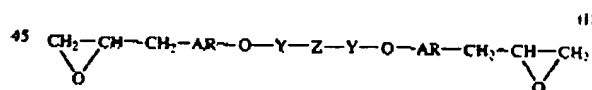
Preparation of 4-[2-(2,3-Epoxypropyl)Phenyl]Sulfone

This compound was prepared using dichlorophenyl sulfone and 2-allylphenol as described in Example 10. The compound is a viscous liquid and was purified by column chromatography utilizing silica gel. 1H NMR (300 MHz, $CDCl_3$) δ 3.35 (dq, 2, CH_2 epoxypropyl), 3.91 (dq, 2, CH_2 epoxypropyl), 5.03–5.20 (m, 1, CH epoxypropyl), 6.84–7.03 (m, 2, aromatic), 7.22–7.35 (m, 2, aromatic), 7.75 (d, 2, aromatic).

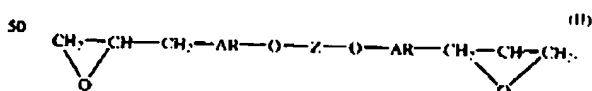
The preparation of epoxy resins from the described epoxides of the present invention follows procedures described in the literature for the preparation of epoxy resins.

What is claimed is:

1. Diepoxide ethers of allyl phenols having the formulas:

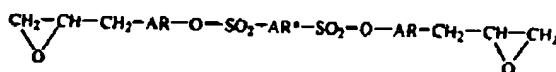


and



where Y is a CO, CO_2 or SO_2 , AR is the same or different divalent unsubstituted or substituted aromatic, halogen-substituted aromatic or cyano-substituted aromatic hydrocarbon radical having from 6 to 20 carbon atoms, Z is a divalent hydrocarbon or ether radical having from 1 to 20 carbon atoms, and Y-Z-Y is CO.

2. The diepoxide esters of claim 1 having the formula:



where AR^* is a divalent aromatic radical of 6 to 20 carbon atoms.